substantially straight line relative to the ceramic discharge vessel.

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18. A lamp as claimed in claim 17, wherein said field wire is formed from stainless steel.

19. A lamp as claimed in claim 17, wherein said ceramic discharge vessel is wound with a conductive antenna coil.

20. A lamp as claimed in claim 17, wherein the field wire substantially follows the contours of the glass bulb.

REMARKS

The drawings are objected to because they include the reference numeral 11 that is not mentioned in the specification. However, reference numeral 11 is described in the specification at page 10, lines 15 and 16 as being a glass stem. Accordingly, amendment is not proposed. However, attached hereto is a proposed amendment to the drawings to insert a reference to a distance D in an attempt to clarify and make the claims more definite.

Claims 1 to 20 are now in this case.

The claims have been amended to more particularly define the invention.

Claims 1, 4, 7 and 8, claim 4, and claims 7 and 8 are separately objected to for the reasons set forth at page 2 of the Office Action. The claims as amended are no longer subject to this ground of objection.

Claims 1-8 stand rejected under 35 U.S.C. 112 as being

indefinite in the terms that describe the distance of the frame wire from the arc tube, the Examiner suggesting that a specific distance or range in millimeters be inserted. Applicant has amended Claim 9 and claims dependent therefrom to recite a minimum distance. However, it is Applicant's opinion that it is proper under the circumstances of this invention to claim this aspect of the invention in functional terms to avoid unduly limiting the scope of the invention. To further clarify the claims, the present amendment amends the claims to refer to a distance D from a center portion of the arc tube to a center portion of the frame wire, and has also proposed amendment to the drawings to insert a reference to the distance D in an attempt to clarify and make the claims more definite. It is submitted that the claims are fully in compliance with 35 U.S.C. 112 and rejection on this basis should be withdrawn.

Claims 1-3, and 5-6 stand rejected under 35 U.S.C. 103 (a) as being unpatentable over Larson, U.S. 4,491,766.

Claims 4, 7, and 8 stand rejected as unpatentable over Larson in view of Geijtenbeek et al.

Reconsideration of the claims and withdrawal of the rejections is requested.

In recent years, ceramic metal halide lamps (for example, Philips MasterColor® Series) have entered the market place. The MasterColor lamps are versatile light sources, since they can be mounted in either regular glass or quartz bulbs or in PAR reflectors. Existing Philips MasterColor ceramic metal halide lamps include such lamps having a wattage of 39W-150W, also referred to as CDM lamps). Recently, the MasterColor lamp series has been extended

via work performed in our laboratory to higher wattages (up to 1000W). These ceramic metal halide lamps display excellent initial color consistency, superb stability over life (lumen maintenance >80%, color temperature shift <200K at 10,000 hrs), high luminous efficacy of >90 lumens/watt and a lifetime of about 20,000 hours. These highly desirable characteristics are due to the high stability of the polycrystalline alumina (PCA) envelopes and a special mixture of salts, which emits a continuous-spectrum light radiation close to natural light and other parameters that have been identified and developed.

One current design of high wattage MasterColor lamps utilizes a cylindrical PCA discharge tube with extended plugs for securing electrodes. The approximate range of aspect ratio of the PCA discharge tube, i.e. length/diameter, of the PCA body is about 3 to 10, with the distance between two electrodes ranging from 10mm to 60mm. For the top of the line 400W and 1000W lamps, the lamp current is approximately 4.5A (ANSI standard) in steady state operation and is approximately 7-8A during warm up. The mount structure of the high wattage MasterColor lamps include a standard glass bulb with gas filling or vacuum, stem, connectors, getters, current carrying frame wire, and ignition aids such as UV enhancer or antenna. In the current design, the frame wire is straight and is mounted on the stem in parallel to the arc tube, and is similar to most HPS lamp constructions. The distance between the frame wire and arc tube surface is about 15mm.

There are two consequences of this configuration: (1) the large current carried by the frame wire generates an AC magnetic field. The magnetic field interacts with the electrons and ions of the

plasma stream. We have observed that the magnetic force is strong enough to push the plasma stream away from the axis of the PCA and results in arc bending. As a consequence of the arc bending, the PCA surface becomes extremely hot and adversely affects the life and other properties of the lamp. From working experience, we have found that the maximum working temperature of the PCA surface should not exceed 1250° C. The curving arc, which creates a much higher local surface temperature on the opposite side of the frame wire, results in PCA damage and even cracks; (2) The portion of the frame wire near the center of the arc tube is heated to well above 500°C by the heat emitted from the arc tube. Under such a high temperature, the frame wire made with the most common stainless steel (e.g. AISI 430) would slowly evaporate and deform to blacken the bulb and lose strength. In order to overcome the problem, a special high temperature alloy has to be used, which adds toward the cost of the lamp.

Prior art proposals that comprise quartz metal halide lamps with a relatively short, spherical arc tube are not relevant art because the dimensions of which tubes are such that arc bending is not a problem, and indeed arc bending is not addressed. In addition, the surface temperatures of the quartz metal halide arc tube are significantly lower than the ceramic metal halide arc tube at same power. Therefore the heat impact on the frame wire is much smaller for the quartz metal halide lamps, so that the frame wire overheating is also not a problem, and indeed it is not addressed. See the specification at page 4, et seq. In addition, prior structures are discussed at page 5 et seq. of the specification which employ what is conventionally referred to as field wires which

do not support the arc tube and wherein the field wires are thin, i.e., they are typically effective to pass a current of about 3 amps but are insufficient to pass higher currents such as the 5-7 amps typically encountered with the high wattage ceramic metal halide lamps of the types under consideration herein. Here also, a relatively short, spherical arc tube is employed, the dimensions of which tube are such that arc bending is not a problem, and indeed arc bending is not addressed. These patents also are directed to the problem of diminishing the effect of photoelectrons which accelerate the depletion of sodium within the discharge vessel and thus shorten the useful life of the lamp. Moreover, attempts in Applicant's laboratory to prepare lamps according to the invention with such thin wires as disclosed in these patents were unsuccessful due to, among other failures, field wire melting at 5 amps. Increasing the diameter of the field wire could effectively reduce the temperature of the field wire and prevent it from melting. However, the flexibility of the field wire would be lost. Therefore the whole mount structure cannot be inserted into a standard size glass bulb through the narrow neck next to the base of the lamp.

There is a need in the art for HID lamps of the ceramic metal halide type with power ranges of about 150W to about 1000W, and for such lamps in which the arc bending problem is eliminated or at least minimized, and/or in which the frame wire temperature does not exceed the operation limit while using common stainless steel as the frame wire material and the present invention fills such need.

Larson, U.S. Patent 4,491,766, is assigned to an Affiliated Company of the instant assignee and discloses in Fig. 2 an HID metal halide lamp having a quartz arc tube. Arc bending is not disclosed by this reference and the component 74 of Figure 2 is not a frame wire as claimed herein because it does not support the arc tube. The only indicated purpose for the wire is to conduct electrical current. Absent Applicant's disclosure, there is no suggestion that a curved frame wire used in a high power metal halide lamp with a ceramic discharge vessel would be effective to cure arc bending as claimed herein.

Geijtenbeek, U.S. Patent 6,147,453 is insufficient to cure the deficiencies of Larson pointed to above. The lamps of Geijtenbeek are not disclosed to be in the lamp power range as disclosed and claimed herein, in which arc bending and heat trauma is much more evident than in the lower wattage lamps. Neither Larson nor Geijtenbeek mention the arc bending and heat trauma associated with a high aspect ratio or a high wattage lamp and the impact of the same on lamp life. It is moreover submitted that the combination of Geijtenbeek and Larson is incongruous, there being no suggestion or motivation for combining the same.

The rejection under 35 U.S.C. 103 is untenable and should be withdrawn.

It is submitted that this application is in condition for allowance. An early issuance is solicited.

An Appendix showing the marked up version of the amended specification and claims is attached.

Respectfully submitted,

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On 02-APRIL-2003

By Pamela Bailey

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APPENDIX A

Amended Specification

At page 4, in the Paragraph beginning at line 3, rewrite to read as follows:

European Patent Application EP-342721, assigned to the same assignee as in this application, discloses an electric discharge lamp having a metallic frame for supporting a discharge vessel within an outer envelope, and has a frame portion along the discharge vessel. To suppress photo-emission of electrons the frame portion is coated with a granular oxide and the coated frame portion is bent outwardly to extend adjacent the outer envelope. This lamp is a quartz metal halide lamp with a relatively short, spherical arc tube, the dimensions of which tube are such that arc bending is not a problem, and indeed arc bending is not addressed. In addition, the surface temperatures of the quartz metal halide arc tube are significantly lower than the ceramic metal halide arc tube at same power. Therefore the heat impact on the frame wire is much smaller for the quartz metal halide lamps, so that the frame wire overheating is also not a problem, and indeed it is not addressed. This patent is directed ~~European Patent Application EP-342721, assigned to the same assignee as in this application, discloses an electric discharge lamp having a metallic frame for supporting a discharge vessel within an outer envelope, and has a frame portion along the discharge vessel. To suppress photo-emission of electrons the frame portion is coated with a granular oxide and the coated~~

~~frame portion is bent outwardly to extend adjacent the outer envelope. This lamp is a quartz metal halide lamp with a relatively short, spherical arc tube, the dimensions of which tube are such that arc bending is not a problem, and indeed arc bending is not addressed. This patent is directed~~ to the problem of diminishing the effect of photoelectrons which accelerate the depletion of sodium within the discharge vessel and thus shortens the useful life of the lamp.

At page 9, in the paragraph beginning at line 1, rewrite to read as follows:

In preferred embodiments of the invention, the lamps will exhibit one or more of the common characteristics of higher wattage MasterColor® lamps: the aspect ratio, which is a measure of the size of the ac tube, since it the ratio of the length (preferably the inner length) of the arc tube to the diameter (preferably the inner diameter) of the arc tube. The aspect ratio of the arc tube body of the lamps of this invention is higher than that of the lower wattage MasterColor lamps, e.g. (30-150W). The aspect ratio of the arc tube body of lower wattage lamps is about 1.0-1.5. These smaller, relatively short, often spherical arc tubes have such dimensions that arc bending is not a problem. However, ~~For~~ for ~~-~~any given lamp power ~~fothe~~ of the lamps of the present invention, in the preferred embodiments, the aspect ratio ~~(length/diameter)~~ falls into a range of about 3.3-6.2 and arc bending is addressed. ~~and/or the~~ Preferred lamps herein are ceramic metal halide lamps of the Philips MasterColor® series and display excellent initial color

consistency; and/or superb stability over life (lumen maintenance >80%, color temperature shift <200K at 10,000 hrs); and/or high luminous efficacy of >90 lumens/watt; and/or a lifetime of about 20,000 hours; and/or power ranges of about 150W to about 1000W; and in each instance, will employ at least one curved frame wire which extends adjacent the glass bulb and is effective to at least minimize arc bending when the lamp is operated; and/or lamps are provided having a power range of about 150W to about 1000W and exhibiting one or more of a characteristic selected from the group consisting of a CCT (correlated color temperature) of about 3800 to about 4500K, a CRI (color rendering index) of about 70 to about 95, a MPCD (mean perceptible color difference) of about $\pm$10, a luminous efficacy up to about 85-95 lumens/watt, in which the arc bending problem is eliminated or at least minimized.

APPENDIX B

Amended Claims

We claim:

1. (amended) A discharge lamp ~~(1)~~ comprising an outer bulb ~~(10)~~ enclosing a ceramic discharge vessel ~~(20)~~ enclosing a discharge space ~~, said cylindrical ceramic discharge vessel including within said discharge space~~ which contains an ionizable material comprising a metal halide; a first and second discharge electrode feedthrough means ~~(30, 40)~~; and a first and second current conductor ~~(12, 13)~~ connected to said first and second discharge electrode feedthrough means ~~(30, 40)~~, respectively;

said lamp having a single substantially curved frame wire ~~(17)~~, connected to one of said current conductors ~~(12, 13)~~, and extending between said ceramic discharge vessel and said glass bulb, ~~and~~ said curved frame wire being curved away from said ceramic discharge vessel and toward said glass bulb at least in a center portion adjacent a center portion of the ceramic discharge vessel whereby said center portion of said curved wire frame and said center portion of said ceramic discharge vessel are separated ~~from the discharge vessel~~ by a distance D effective to reduce arc bending when compared to a discharge lamp wherein said frame wire extends substantially parallel to said glass bulb and a center portion of the said frame wire adjacent a center portion of the ceramic

discharge vessel and is separated by a distance D1 that is less than said distance D. ~~the ceramic discharge vessel~~.

2. A lamp as claimed in claim 1, wherein the ceramic discharge vessel is a substantially cylindrical arc tube.

3. (amended) A lamp as claimed in claim 2, wherein said curved frame wire ~~(17)~~ extends outwardly from said arc tube ~~(20)~~ at a distance whereby the maximum distance D between the center portion of the arc tube and the center portion of the curved frame wire ~~(17)~~ is at least twice the distance D1 ~~when compared to~~ from the center portion of the arc tube to the center portion of the field wire in a discharge lamp wherein said frame wire extends substantially parallel to the arc tube.

4. (amended) A lamp as claimed in claim 2, having a power range of about 150W to about 1000W and exhibiting one or more of a characteristic selected from the group consisting of a ~~CCT~~ ~~(~~correlated color temperature~~)~~ of about 3800 to about 4500K, a ~~CRI~~ ~~(~~color rendering index~~)~~ of about 70 to about 95, a ~~MPCD~~ ~~(~~mean perceptible color difference~~)~~ of about ±10, and a luminous efficacy up to about 85-95 lumens/watt and /or in which the heat impact of the arc tube on the lamp components does not effectively reduce the lamp life.

5. (amended) A lamp as claimed in claim 2, wherein said curved frame wire ~~(17)~~ is a curved frame wire that extends adjacent to and substantially follows the contour of the glass bulb ~~(10)~~ and in

which the heat impact of the arc tube on the lamp components does not effectively reduce the lamp life.

6. A lamp as claimed in Claim 1 retrofit with ballasts designed for high pressure sodium or quartz metal halide lamps.

7. (amended) A lamp as claimed in claim 2, wherein the approximate range of the aspect ratio of the arc tube ~~(20)~~ is about 3 to 10, with the distance between two electrodes ~~(30, 40)~~ ranging from 10mm to 60mm.

8. A lamp as claimed in claim 7, wherein the aspect ratio of said arc tube falls within the range of about 3.3-6.2.

9. A discharge lamp having a power range of about 150W to about 1000W and exhibiting one or more characteristics selected from the group consisting of a correlated color temperature of about 3800 to about 4500K, a color rendering index of about 70 to about 95, a mean perceptible color difference of about +10, and a luminous efficacy up to about 85-95 lumens /watt and/or in which the heat impact of the arc tube does not effectively reduce the lamp life, and comprising an outer bulb enclosing a cylindrical ceramic discharge vessel having an aspect ratio in the range of about 3 to 10 and enclosing a discharge space which contains an ionizable material comprising a metal halide; a first and second discharge electrode feedthrough means, the distance between said electrodes being about in the range of about 10mm to about 60mm,; and a first and second

current conductor connected to said first and second discharge electrode feedthrough means, respectively;

said lamp having a single substantially curved frame wire supporting the ceramic discharge vessel and connected to one of said current conductors, and extending between said ceramic discharge vessel and said glass bulb, said curved frame wire being curved away from said ceramic discharge vessel and toward said glass bulb at least in a center portion so as to be separated from the discharge vessel by a distance D of at least 10mm ~~effective~~ to reduce arc bending when compared to said ~~a~~ discharge lamp wherein said frame wire extends substantially parallel to and in a substantially straight line relative to the ceramic discharge vessel and at a smaller distance therefrom.

10. A lamp as claimed in claim 9, wherein said field wire is formed from stainless steel.

11. A lamp as claimed in claim 1, wherein said field wire is formed from stainless steel.

12. A lamp as claimed in claim 2, wherein said field wire is formed from stainless steel.

13. A lamp as claimed in claim 1, wherein said ceramic discharge vessel is wound with a conductive antenna coil.

14. A lamp as claimed in claim 2, wherein said ceramic discharge vessel is wound with a conductive antenna coil.

15. A lamp as claimed in claim 9, wherein said ceramic discharge vessel is wound with a conductive antenna coil.

16. A lamp as claimed in claim 9, wherein the field wire substantially follows the contours of the glass bulb.

17. A discharge lamp comprising an outer bulb enclosing a ceramic discharge vessel and enclosing a discharge space which contains an ionizable material comprising a metal halide; a first and second discharge electrode feedthrough means, and a first and second current conductor connected to said first and second discharge electrode feedthrough means, respectively;
said lamp having a single substantially curved frame wire supporting the ceramic discharge vessel and connected to one of said current conductors, and extending between said ceramic discharge vessel and said glass bulb, said curved frame wire being curved away from said ceramic discharge vessel and toward said glass bulb at least in a center portion adjacent a center portion of said discharge vessel so as to be separated from the discharge vessel by a distance D effective to reduce arc bending when compared to said discharge lamp when said frame wire extends substantially parallel to and in a substantially straight line relative to the ceramic discharge vessel.

18. A lamp as claimed in claim 17, wherein said field wire is formed from stainless steel.

19. A lamp as claimed in claim 17, wherein said ceramic discharge vessel is wound with a conductive antenna coil.

20. A lamp as claimed in claim 17, wherein the field wire substantially follows the contours of the glass bulb.